PATENT CLAIMS

1. Adjustable mechanism for a motor vehicle for adjusting an adjustable part in a motor vehicle, more particularly a seat part, with a spindle nut defining an axis and interacting on the one side with a threaded spindle and on the other side having in an external surface an external toothing through which it engages with a further gearing element,

characterised in that

the external toothing (15) of the spindle nut (1) is formed through radially inwardly pointing indentations in the external surface (10) of the spindle nut (1) whose tooth depth diminishes towards at least one axial end of the spindle nut (1).

2. Adjustable mechanism according to claim 1, **characterised in that** the tooth depth of the external toothing (15) decreases to zero at at least one axial end of the spindle nut (1).

3. Adjustable mechanism according to claim 1 or 2, **characterised in that** the external toothing (15) of the spindle nut (1) extends in the axial direction (a) only over a part of the axial extension of the outer surface (10) of the spindle nut (1) so that the spindle nut (1) has in the axial direction (a) on the other side of the external toothing (15) at least one end section (11, 12) without external toothing.

4. Adjustable mechanism according to claim 3, **characterised in that** the at least one axial end section (11, 12) of the spindle nut (1) without external toothing is formed substantially as a circular line.

5. Adjustable mechanism according to one of the preceding claims, **characterised in that** the external toothing (15) of the spindle nut (1) is formed by indentations in the external surface (10) of the spindle nut (1) in relation to at least one end section (11, 12) of the spindle nut (1).

6. Adjustable mechanism according to one of the preceding claims, **characterised in that** the spindle nut (1) has in the axial direction (a) either side of the external toothing (15) an end section (11, 12) without external toothing.

7. Adjustable mechanism according to one of claims 3 to 6, **characterised in that** the spindle nut (1) has an external surface (10) in the form of a cylinder sleeve and that the external toothing (15) is formed by indentations in the external surface (10) whereby the diameter of the at least one end section (11, 12) is preferably larger than or equal to the diameter of the external surface (10) which is provided with indentations

8. Adjustable mechanism according to one of claims 3 to 7, **characterised in that** the spindle nut (1) in the region of the external toothing (15) does not project in the radial direction (r) beyond the at least one end section (11, 12).

9. Adjustable mechanism according to one of the preceding claims, **characterised in that** the external toothing (15) is globoid in shape and more particularly has globoid toothing in its axial edge regions (17, 18).

10. Adjustable mechanism according to one of the preceding claims, **characterised in that** the external toothing (15) has an involute profile in a middle section (16) in the axial direction (a).

11. Adjustable mechanism according to one of the preceding claims, **characterised in that** the spindle nut (1) is made of plastics.

12. Adjustable mechanism according to one of the preceding claims, **characterised in that** the spindle nut (1) interacts with a worm as a further gearing element (2) through its external toothing (15).

13. Adjustable mechanism according to one of the preceding claims, **characterised in that** the internal toothing (19) of the spindle nut (1) associated with the spindle (100) extends in the axial direction (a) over a greater length that the external toothing (15) so that the internal toothing (19) extends axially up into at least one end section (11, 12).

14. Adjustable mechanism according to one of the preceding claims, **characterised in that** the tooth thickness (d) of the internal toothing (19) of the spindle nut (1) interacting with the threaded spindle (100) is greater than its gap width (e).

15. Adjustable mechanism according to one of the preceding claims, **characterised in that** the spindle nut (1) and the further gearing element (2) are mounted in a gearbox housing (3,4).

16. Adjustable mechanism according to claim 15, **characterised in that** the gearbox housing (3, 4) is formed by housing parts (31, 32; 41, 42) more particularly in the form of housing plates.

17. Adjustable mechanism according to claim 16, **characterised in that** the housing parts (31, 32; 41, 42) are connected to one another through push-fit connections (35, 45) and are aligned relative to each other along all spatial directions.

18. Adjustable mechanism according to claim 16 or 17, **characterised in that** the gearbox housing (3, 4) consists of one or two pairs of opposing housing parts (31, 32; 41, 42).

19. Adjustable mechanism according to one of claims 16 to 18, **characterised in that** the gearbox housing (3, 4) comprises two external housing parts (41, 42) which have a U-shaped cross-section.

20. Adjustable mechanism according to claim 19, **characterised in that** the outer housing parts (41, 42) engage round bearing parts (31, 32) mounted opposite one another in the axial direction (a) to support the spindle nut (1).

21. Adjustable mechanism according to claim 20, **characterised in that** the outer housing parts (41, 42) surround bearing sections (33, 34) of the bearing parts (31, 32).

22. Adjustable mechanism according to one of claims 15 to 21, **characterised in that** the gearbox housing (3, 4) is of plastics.

23. Adjustable mechanism according to one of claims 15 to 22, **characterised in that** the gearbox housing has bearing points (33, 34; 46) more particularly in the form of bearing openings for the spindle nut (1) and/or the further gearing element (2).

24. Adjustable mechanism according to one of the preceding claims, **characterised in that** a bearing collar (13, 14) for supporting the spindle nut (1) protrudes from the axial end sections (11, 12) of the spindle nut (1).

25. Adjustable mechanism according to claim 6 or one of claims 7 to 23 as well in relation to claim 6, **characterised in that** the end sections (11, 12) serve at the same time as bearings for supporting the spindle nut (1) whereby the axial and radial bearing is produced through a pair of housing parts (41, 42) of a gearbox housing.

26. Adjustable mechanism according to one of claims 15 to 25, **characterised in that** the gearbox housing (3, 4) has in at least one boundary wall a recess (48, 49) in which the spindle nut (1) and/or further gearing element (2) radially engages.

27. Adjustable mechanism according to claim 26, **characterised in that** the recess (48, 49) is formed through an opening in the relevant boundary wall.

28. Adjustable mechanism according to claim 26, **characterised in that** the recess is formed through an indentation in the relevant boundary wall.

29. Adjustable mechanism according to one of claims 26 to 28, **characterised in that** in the gearing housing (3, 4) are formed two recesses (46) set opposite one another across the axis (L) of the spindle nut (1) for the spindle nut (1).

30. Adjustable mechanism according to one of claims 26 to 29, **characterised in that** in a boundary wall of the gearbox housing (3, 4) a recess (49) is formed for the side of the further gearing element (2) remote from the spindle nut (1).

31. Adjustable mechanism according to one of claims 15 to 30, **characterised in that** between the gearbox housing (3, 4) and an associated holder (5) of the gearbox housing (3, 4) there is at least one element for acoustic uncoupling which is formed preferably as a resilient element.

32. Adjustable mechanism according to claim 31, **characterised in that** the elastic elements are moulded, more particularly injected, in one piece on the gearbox housing.

33. Adjustable mechanism according to one of claims 11 to 28, **characterised in that** between at least one axial end of the spindle nut (1) and the gearbox housing (3, 4) there is a separate reinforcement ring which is preferably mounted on a bearing collar (13, 14) of the spindle nut (1).

34. Adjustable mechanism according to one of claims 15 to 33, **characterised in that** the housing parts (31, 32; 41, 42) are connected to one another through laser welding.

35. Adjustable mechanism according to claim 34, **characterised in that** the gearbox housing (3, 4) has internal housing parts (31, 32) and external housing parts (41, 42) whereby the material of the outer housing parts (41, 42) is designed transparent for the laser beam used for welding, and the material of the inner housing parts (31, 32) is designed non-transparent for the laser beam used so that a connection with the outer housing parts (41, 42) can be produced through partial melting of the inner housing parts (31, 32).

36. Adjustable mechanism according to claims 11, 20 and 22, **characterised in that** at least the spindle nut (1) and the bearing plates (31, 32) of the gearbox housing (3, 4) are made together in one injection moulding tool.

37. Adjustable mechanism according to one of the preceding claims, **characterised in that** the gearbox housing (3, 4) is set in a holder (5) of U-shaped cross-section by means of which it can be fixed against an associated adjustable part.

38. Method for manufacturing an adjustable mechanism with the features of claims 1, 11, 20 and 22, **characterised in that** the spindle nut (1) and the bearing parts (31, 32) are made together in one injection moulding tool in a multi-stage injection moulding process.

39. Method according to claim 38, **characterised in that** the spindle nut (1) and the bearing parts (31, 32) are made in the injection moulding tool one after the other through injection moulding whereby the structural assembly unit each previously made remains in the injection moulding tool whilst the next assembly unit to be made is injected.

40. Method according to claim 38 or 39, **characterised in that** further parts of the gearbox housing (3, 4) are made in the injection moulding tool whilst the previously made structural assemblies (1, 31, 32) remain in the injection moulding tool.

41. Method according to one of claims 7 to 40, **characterised in that** outer U-shaped housing parts (41, 42) of the gearbox housing (3, 4) are made in the injection moulding tool.

42. Method according to one of claims 38 to 41, **characterised in that** the further gear element (2) is inserted in the injection moulding tool before the parts (41, 42) of the gearbox housing (3, 4) which are provided for supporting the further gear element (2) are made by injection moulding.

43. Method according to one of claims 38 to 42 for manufacturing an adjustable mechanism with the features of claim 34, **characterised in that** before or during the connection of the housing parts (31, 32; 41, 42) by laser welding

any axial bearing play between the inner housing parts (31, 32) of the gearbox housing (3, 4) and the spindle nut (1) is removed.

44. Method according to claim 43, **characterised in that** the axial bearing play is removed by

a) applying a defined axial force to the inner housing parts (31, 32)

b) melting regions of the inner housing parts (31, 32) which are enclosed by the push-in areas (45) of the outer housing parts (41, 42) as well as

c) terminating the laser welding when the at least one end section (11, 12) of the spindle nut (1) bears against the gearbox housing (3, 4).

45. Method for mounting an adjustable mechanism (1, 2) mounted in a gearbox housing (3, 4) for a motor vehicle wherein at least one housing part (41) is brought into engagement with a further housing assembly unit (3, 42) and the housing part (41) is fixed against the further housing assembly unit (3, 42) in that material is melted in the engagement area (35, 45) of the housing part (41) with the housing assembly (3, 42), more particularly to assemble an adjustable mechanism according to one of claims 1 to 37, **characterised in that** the housing part (41) and the further housing assembly (3, 42) are tensioned elastically against one another during the melting.

46. Method according to claim 45, **characterised in that** a tension device engages on the housing part (41) and/or the further housing assembly (3, 42) in order to tension the housing part (41) and the further housing assembly (3, 42) relative to one another.

47. Method according to claim 46, **characterised in that** the tension device engages on the associated element (3, 41, 42) of the housing (3, 4) with the interposition of an elastic element (E).

48. Method according to claim 47, **characterised in that** a compression spring is used as the elastic element (E).

49. Method according to one of claims 45 to 48, **characterised in that** the housing part (41) and the further housing assembly (3, 42) are brought into engagement with one another along an installation axis (A).

50. Method according to claim 49, **characterised in that** the engagement area (35, 45) is formed by a push-in area and the housing part (41) and the further housing assembly (3, 42) are brought into engagement with one another by fitting one in the other.

51. Method according to claim 49 or 30, **characterised in that** the housing part (41) and the further housing assembly (3, 42) are tensioned against one another along the installation axis (A).

52. Method according to one of claims 49 to 51, **characterised in that** the housing part (41) and the further housing assembly (3, 42) are tensioned relative to one another in a direction (a) which has a direction component transversely to the installation axis (A).

53. Method according to claim 52, **characterised in that** the housing part (41) and the further housing assembly (3, 42) are tensioned relative to one another perpendicular to the installation axis (A).

54. Method according to one of claims 45 to 53, **characterised in that** a second housing part (42) is used as the further housing assembly unit.

55. Method according to claim 54, **characterised in that** the two housing parts (41, 42) are fixed directly one against the other.

56. Method according to one of claims 45 to 53, **characterised in that** the further housing assembly group (3) is housed between the housing part (41) and a second housing part (42) whereby the two housing parts (41, 42) are each brought into engagement with one end side (35) of the housing assembly unit (3) and are fixed against the associated end side (35) in that material of the housing part (41, 42) and/or of the housing assembly unit (3) is fused in the engagement area (45) of the relevant housing part (41, 42) with the associated end side (35) of the housing assembly unit (3).

57. Method according to claim 56, **characterised in that** the two housing parts (41, 42) are tensioned relative to each other whereby at least one of the two housing parts (41, 42) is also tensioned relative to the further housing assembly unit (3).

58. Method according to claim 46 and 57, **characterised in that** the two housing parts (41, 42) are tensioned against one another along the installation axis (A).

59. Method according to claim 46 and claim 57 or 58, **characterised in that** the two housing parts (41, 42) are tensioned relative to one another along a direction (a) which has a direction component perpendicular to the installation axis (A).

60. Method according to claim 59, **characterised in that** the two housing parts (41, 42) are tensioned relative to each other along a direction extended perpendicular to the installation axis (A).

61. Method according to one of claims 50 to 60, **characterised in that** the further housing assembly unit (3) is formed by two housing elements (31, 32) which are opposite one another perpendicular to the two housing parts (41, 42).

62. Method according to one of claims 45 to 61, **characterised in that** a housing plate is used for the at least one housing part (41).

63. Method according to one of claims 45 to 62, **characterised in that** during melting of the material in the engagement area (35, 45) the at least one housing part (41) executes a settling movement(s) relative to the further housing assembly unit .

64. Method according to claim 63, **characterised in that** the settling movement(s) takes place in the direction of the elastic pretension.

65. Method according to one of the preceding claims 45 to 63, **characterised in that** the material is melted in the engagement area (35, 45) by means of a laser.

66. Method according to claim 65, **characterised in that** non-melting areas (41, 42) of the housing (3, 4) are made from material which is permeable to the laser beam used.

67. Method according to one of claims 45 to 66, **characterised in that** the duration of the melting process is controlled from a predeterminable criterion.

68. Method according to claim 63 or 64 and claim 67, **characterised in that** the duration of the melting process is controlled in dependence on the settling movement (s) of the at least one housing part (41).

69. Method according to claim 68, **characterised in that** the duration of the melting process is controlled in dependence on the speed and/or the dynamics of the settling movement (s).

70. Method according to one of claims 67 to 69, **characterised in that** the duration of the melting process is controlled in dependence on the change in the reaction force (F) during tensioning of the at least one housing part (41) relative to the further housing assembly unit (3, 42).

71. Method according to claim 68, **characterised in that** the duration of the melting process is controlled in dependence on the extent of the settling movement (s).

72. Method according to claim 67, **characterised in that** the duration of the melting process is already fixed at the start of the melting process.

73. Method according to one of claims 45 to 72, **characterised in that** in the engagement area (35, 45) of the at least one housing part (41) with the further housing assembly unit (3) is a clearance (45a) into which flows the melted mass (G) formed by the melting of the material.

74. Method according to claim 70 and 73, **characterised in that** the clearance (45a) is formed in the push-in area (35, 45).

75. Method according to one of claims 45 to 74, **characterised in that** the quality of the connection between the at least one housing part (41) and the further housing assembly unit (3, 42) is monitored during the melting process from the extent of the movement of the housing part (41) relative to the further housing assembly unit (3, 42).

76. Method according to claim 63, 65 and 75, **characterised in that** the laser power is regulated in dependence on the speed of the settling movement.

77. Method according to one of claims 45 to 74, **characterised in that** the at least one housing part (41) and the further housing assembly unit (3, 42) are made of plastics.